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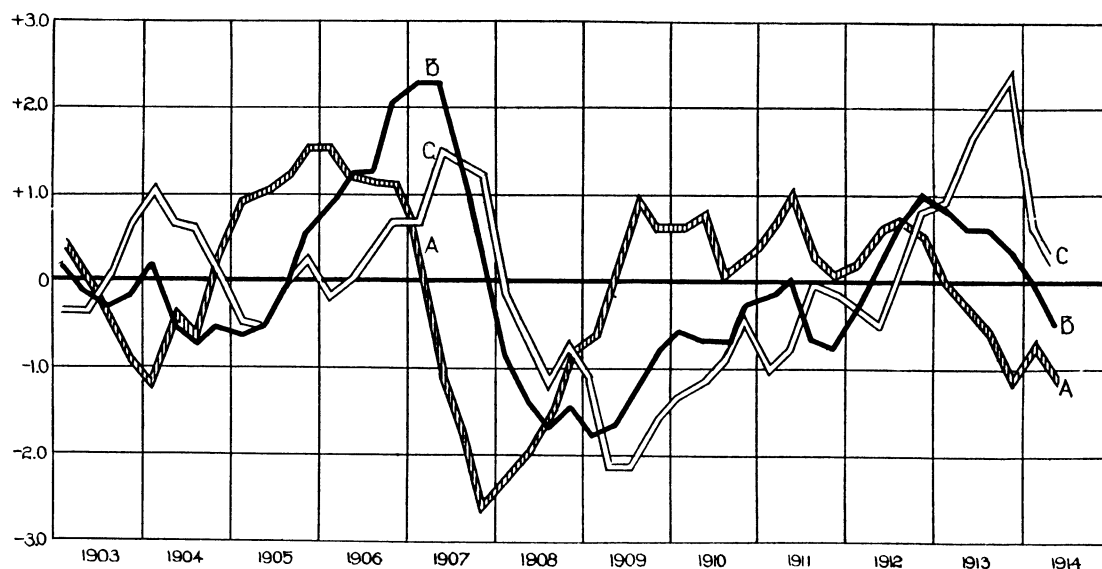
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AN INDEX OF BRITISH ECONOMIC CONDITIONS

1903-14

INDEX OF BRITISH ECONOMIC CONDITIONS, 1903-14



The three representative series are:

- (A) *Stock prices*. — Market values of securities (*Bankers' Magazine* total less fixed-interest securities).
- (B) *Wholesale prices*. — Sauerbeck-Statist price index for "all materials." Note: An index of the volume of business in the United Kingdom, which generally fluctuates with commodity prices, is given in Chart 5 on p. 164.
- (C) *Interest rates*. — Market values of 7 local government bonds (signs reversed in order to show long-time interest rates).

Prices (B), reflecting the general ebb and flow of business, tend to be forecast by speculation (A) and to be followed by the long-time rate of interest (C).

AN INDEX OF BRITISH ECONOMIC CONDITIONS

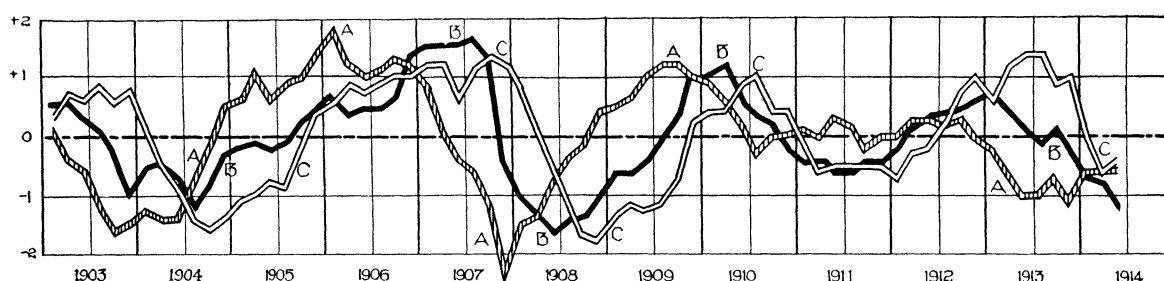
1903-14

WARREN M. PERSONS, NORMAN J. SILBERLING, AND WILLIAM A. BERRIDGE

THE purpose of the Index of General Business Conditions for the United States published currently in graphic form in THE REVIEW OF ECONOMIC STATISTICS is to provide, first, a record of fluctuations during alternating periods of business prosperity and depression and, second, a basis for forecasting at any time the

variation, cyclical fluctuation, and a residual factor.¹ In order, therefore, to secure data that would reveal the ebb and flow of the business cycle the original series of statistics were adjusted so as to eliminate the influence of secular trend and seasonal variation, and thus bring out clearly the movement resulting from business

CHART 1.—THE INDEX OF GENERAL BUSINESS CONDITIONS FOR THE UNITED STATES (CYCLES), 1903-14



- (A) *Speculation*: New York bank clearings, average price of industrial stocks, average price of railroad stocks, and average price of railroad bonds.
 (B) *Business*: bank clearings outside of New York City, Bradstreet's index of wholesale commodity prices, Bureau of Labor Statistics' index of wholesale prices, and pig-iron production.
 (C) *Banking*: discount rate on 60-90 day paper in New York City, discount rate on 4-6 months paper in New York City, loans of New York City clearing house banks (signs reversed), and deposits of New York City clearing house banks (signs reversed).

business conditions of the period immediately ahead. The Index (Chart 1), consisting of three curves representing speculation, business, and banking, respectively, resulted from an analysis of the various series of industrial, commercial, and financial statistics which ordinarily serve as a basis for judgments concerning the current fundamental economic situation.

The statistical series utilized in the construction of the Index for the United States, such as averages of commodity and of security prices, interest rates, bank clearings, and production of pig iron, consist of monthly items covering the periods 1903-14 and 1918-22. These statistics, however, were not utilized in their original form. Each actual monthly item in its original form is a composite, the make-up of which depends upon the year, the season, the location in the business cycle of prosperity and depression, the occurrence of unusual events; in technical language, each original item results from a combination of four elements — secular trend, seasonal

cycles. Since the residual element cannot be eliminated it necessarily remains present in the adjusted data. From 1914 to 1918 it dominated all the others, but in ordinary times it is seldom a factor of great importance.

The adjusted series thus secured all have wave movements, but the *times* at which the crests or troughs of the waves of the several series occur are frequently not the same; nevertheless there are *groups* of series in which the wave movements are simultaneous. It was found that when

¹ The *secular trend* is the regular increase or decrease, according to some principle, over the whole period under consideration.

The *seasonal variation* is the movement of the items within the year which we attribute to the round of the seasons.

The *cycles* are the undulating curves, or numerical values secured by removing from the actual items the secular trend and the seasonal variation, and expressing the figures thus corrected in terms of comparable units, the standard deviations.

The *residual element* includes all sporadic developments such as strikes, which affect individual series, or widespread changes due to momentous occurrences, such as wars or national catastrophes, which affect a number of series simultaneously.

compared,¹ each with the other, the series fell into three distinct groups. The series which fluctuate first, either upward or downward, are all series depending upon speculation; those in which the fluctuations follow or lag behind in point of time the fluctuations of the speculative group, all have to do with commodity prices and business activity; those which fall into a third group and whose fluctuations lag behind those of the business group all have to do with banking conditions and the money market. These three groups of series constitute the data for the construction of the three curves, referred to above, of the Index Chart for the United States.²

For one country, then, the United States, and for a limited period, 1903-14, the following conclusions have been reached:

- (a) Various statistical series of monthly items, adjusted for secular trend and seasonal variation, show marked wave-like or cyclical fluctuations.
- (b) The cyclical fluctuations of the various series are, in the main, similar to each other.
- (c) Although the cyclical fluctuations are similar, the time of occurrence of wave movements varies for different series; the movements of some series regularly precede or regularly follow those of other series.
- (d) The series can be sorted, by comparing each curve with the others, into three distinct groups having a sequence of cyclical fluctuations.

¹ In order to express the series, when corrected for secular trend and seasonal variation, in comparable units, each was divided through by its *standard deviation*. This operation has the effect of approximately equalizing the amplitude of the resulting cycles, or the vertical range between peak and trough. The series thus corrected and expressed (called *cycles*) were then compared with one another, at first graphically (through the use of charts on translucent paper) and later in some cases mathematically (through the use of coefficients of correlation). The three curves of the Index Chart for the United States are averages, respectively, of the groups of series having cyclical fluctuations similar in point of time as well as shape.

² See THE REVIEW OF ECONOMIC STATISTICS, January and April, 1919 for a full explanation of the data and methods used in constructing the index. *Interpretation of the Index of General Business Conditions* by Warren M. Persons (published by the Harvard University Committee on Economic Research) is designed to meet the needs of readers who are interested in results rather than in methods or technical details.

- (e) The series in each group are found to be connected with speculation, business, and banking, respectively.
- (f) At a given time the direction, duration, and magnitude of movements, with respect to each other, of the three curves give a forecast of the nature of the cyclical movements in progress and hence the immediate prospect for business in general.

The object of the present study is to analyze for Great Britain the available series of industrial, commercial, and financial statistics for the same period and by the same methods as have been used for the United States. For this object it is necessary to secure statistical series of items pertaining to time intervals short enough — months or quarters — to reveal the turning points of business cycles. Annual data are useful merely as (1) clues to the selection for study of monthly or quarterly series and (2) general supporting evidence for conclusions derived from such study. Some 50 or 60 British statistical series of monthly or quarterly items, collected from a wide variety of sources, were examined. These relate to almost every phase of the business cycle — prices, railway earnings, bank clearings, exports, imports, security prices, discount rates, unemployment, gold movements, and many others. The plan, at first, was to utilize only monthly data, but this proved inadvisable, because for some important series monthly items were not available and for other series the cyclical movements were concealed by oscillating month-to-month fluctuations. The quarter proved to be the most satisfactory standard time unit to adopt for the pre-war period in Great Britain, and such series of monthly figures as were available were thrown into quarterly form by averaging.

Part I of the present study gives a list of the statistical series which have been collected, and found most useful; and it sets forth the course of business in Great Britain during 1903-14 as revealed by the fluctuations of certain statistical series. Part II compares the fluctuations of series representing speculation with those of business. Part III makes a similar comparison between the business curve and interest rates, and presents the Index of British Economic Conditions. Part IV compares the results obtained for Great

Britain with those for the United States, and Part V is a summary. Details concerning the source and nature of the data utilized, equations to the lines of secular trend, indices of seasonal variation, and tables of the actual data as well as the corrected items for the most useful series are given in the Appendix.

I. THE VOLUME OF BUSINESS IN GREAT BRITAIN

The various series which were examined are listed in Table 1. From this list it is desirable first of all to make a selection of those which most accurately indicate business activity — in other words, those series having cyclical fluctuations most nearly concurrent with each other and with general production and trade. This selection is greatly facilitated by using as a preliminary standard of comparison some single series which is acknowledged to reflect business movements with considerable accuracy. For this purpose a series representing the wholesale prices of commodities was taken as the tentative standard for judging the general excellence of other series. Agreement with the movement of prices, therefore, constituted a preliminary test for selecting other series; while substantial and consistent agreement, *inter se*, of the selected series furnished confirmatory evidence that the business cycle was revealed by all of them.

The belief that commodity prices are, in fact, a good and probably the best starting-point for this analysis is warranted by the study of *Indices of General Business Conditions* for the United States and by other studies of business cycles. Students of the phenomena of industrial and commercial cycles almost without exception regard the course of commodity prices as a peculiarly sensitive barometer of business conditions. In a survey of the views of numerous writers, the conclusion was reached by Professor J. H. Williams that “notwithstanding wide differences of opinion regarding the precise function of prices — as to the time relation to other elements in the cycle, as to the question of the automatic character of the price cycle, as to whether all prices or only some special prices are significant — the point of common agreement which stands out from all the diversity of views is that price movements are a significant, and in the minds of most

TABLE 1. — (A) SELECTED STATISTICAL SERIES: GROUPED ACCORDING TO THE SEQUENCE OF THEIR CYCLICAL FLUCTUATIONS AND ARRANGED IN ORDER OF THE SIMILARITY OF THE CYCLES TO THOSE OF COMMODITY PRICES

(The page numbers refer to the Appendix, where the series are described in detail.)

Standard series with which all others were compared:

Sauerbeck-Statist price index for “all materials” (p. 176)

Series having cyclical fluctuations concurrent with or lagging not more than a quarter after those of the standard:

Exports of British produce (value) (p. 178)
Bank clearings in 5 provincial cities (p. 178)
Percentage unemployment in all trades * (p. 178)
Number of blast furnaces in blast (p. 178)
Exports of iron and steel (quantity) (p. 178)
Freight traffic receipts of 16 railways (p. 179)
Imports of raw materials, excluding cotton (value) (p. 177)
Country bank clearings through London Clearing House (p. 179)
London discount rates on 2 to 6 months bills (p. 181)

Series having cyclical fluctuations preceding those of the standard:

Market values of securities (*Bankers' Magazine* total, less fixed interest securities) (p. 180)
Stores of Cleveland pig iron in public warehouses (p. 179)
Market values of British railway ordinary stocks (p. 180)
London bank clearings on stock settling days (p. 179)

Series having cyclical fluctuations following those of the standard by a considerable period:

Market values of local government bonds* (p. 180)
Total market values of fixed-income securities* (p. 180)
Yield on consols (p. 181)

* Signs reversed.

(B) REJECTED SERIES: HAVING FLUCTUATIONS DISSIMILAR TO THOSE OF (A)

Total London clearings (p. 179)
London clearings on consols settling days (p. 179)
Raw cotton forwarded from Liverpool (p. 180)
Exports of cotton piece goods (p. 178)
Merchant shipbuilding under construction (p. 180)
Net gold movements (p. 181)
Market values of “coal, iron and steel” securities (p. 180)
Market values of “commercial and industrial” securities (p. 180)
Bank of England, reserve (p. 183)
Bank of England, other than public deposits (p. 183)
Bank of England, other than public securities (p. 183)
New capital applications (p. 183)
Loans, discounts, etc. of London joint-stock banks (p. 183)

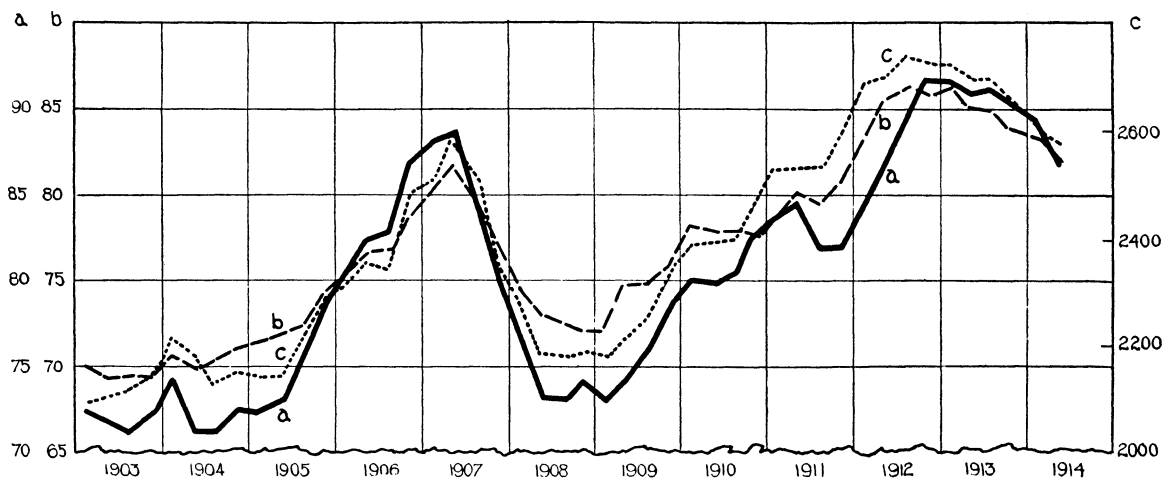
writers the chief, characteristic of the business cycle.”¹ Active business is accompanied by either rising or high commodity prices, while depressed business is accompanied by either falling or low commodity prices.

Having selected wholesale commodity prices as the standard with which to compare the cyclical fluctuations of other statistical series, the question arises as to what price index to use. Among the index numbers of British prices, available in other than annual form, those most commonly cited are the series published by the *Economist* and by the *Statist*. The latter index is that begun and continued for many years by Augustus Sauerbeck. The two sets of indices differ in important respects, particularly in regard to homogeneity during the period now under consideration, and in the special commodity group indices provided.² It is evident from Chart 2 that no great difference exists among the

last named, which is based upon the prices of raw materials, excluding foodstuffs. The reasons for taking an index which excludes foodstuffs are, first, that foodstuffs are properly classed among consumers' goods, not among producers' goods like pig iron, cotton, or wool and second, that the prices of foodstuffs are dependent to a large degree upon crops which in turn are related to weather conditions.³ Of the two sets of price indices which have been mentioned, the Sauerbeck-Statist index alone furnishes a series (curve *a* in Chart 2) comprising all the articles of the general index except vegetable and animal foodstuffs. This series, hereafter referred to as the “all materials” series, is based upon 26 minerals, fibers, and miscellaneous materials and was selected to serve as the standard price series for this study.

After selecting a standard price series, adjusting for secular trend (which from Chart 2 is seen

CHART 2. — BRITISH COMMODITY PRICE INDICES, 1903-14



(a) Sauerbeck-Statist, “all materials.” (b) Sauerbeck-Statist, “all commodities.” (c) Economist, “all commodities.”

price indices for all commodities (curves *b* and *c*) of the *Economist* and the *Statist* and for the latter's “all materials” group (curve *a*). There is theoretical ground, however, for selecting for the present study of business conditions the index

¹ John H. Williams, “The Rôle of Prices in the Business Cycle,” *REVIEW*, April, 1919, p. 210.

² Data relative to these indices will be found in the Appendix (p. 176).

³ For a survey of the relation of agricultural production to prices see this *REVIEW*, February, 1921, p. 34.

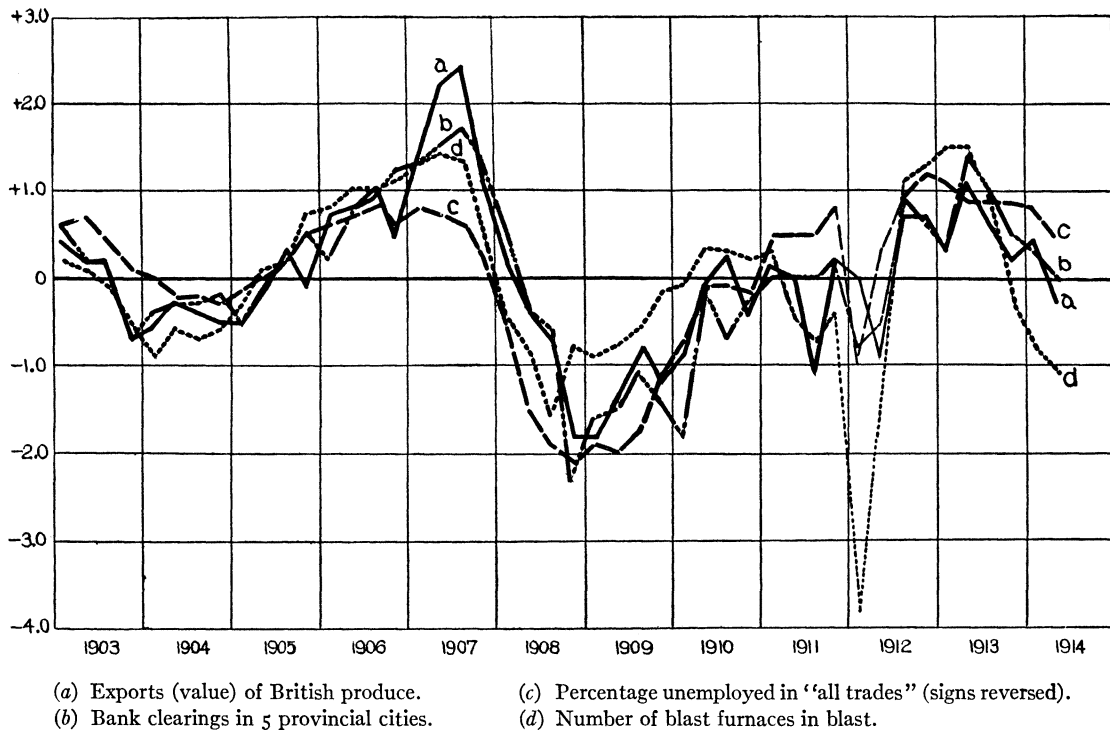
⁴ There is no seasonal variation in this series.

to be decidedly upward), and expressing the results in terms of the “standard deviation,”⁴ the next step was to compare with it other series, likewise adjusted. The resulting “cycle” curves for these series were plotted upon translucent paper in order that the curves might be superimposed upon one another and moved freely backward or forward to a position showing the highest degree of correspondence with one another and with the standard curve of prices. This correspondence was, in some cases, found to

be best for concurrent items; in others for a "lag" or "lead" with reference to the standard series. The conclusion in each case rested on the combined judgment of several independent observers, with reference to: (1) the excellence of the

produce, (b) bank clearings in five provincial towns, (c) percentage of unemployment in all trades (signs reversed), and (d) blast furnaces in blast. The first two series register trade — foreign and domestic — while the last two are meas-

CHART 3.—MOST SATISFACTORY SERIES INDICATING THE VOLUME OF BUSINESS IN GREAT BRITAIN (CYCLES)



agreement of the curves, (2) the existence of a "lead" or "lag," (3) the consistency or regularity with which concurrence, lead, or lag was maintained throughout the period covered. Table 1 gives a list of the series thus analyzed, the series being grouped according to the results of the comparisons just described.

Comparison showed that the cyclical fluctuations of eight series agreed well with those of prices (either concurrently or with a lag of not more than a quarter), and these series were set apart for comparison with each other. Out of the eight series, four were found to move in such close unison as to warrant averaging them in order to iron out the fluctuations peculiar to each series, and to emphasize the cyclical fluctuations showing the general movement of business during the period covered. These four series, which are plotted in Chart 3, are: (a) exports of British

ures of industrial activity; the former involve a price element while the latter do not.

The remaining four series, shown together in Chart 4, while exhibiting in general the same cyclical characteristics that were revealed in the first set, are much less regular in their movements and agree less exactly in detail with either the price index or one another, than do the four series of Chart 3. Still other series which were found not to show any marked regularity in cyclical movements are listed in section (B) of Table 1 and described in the Appendix.

The curve obtained by averaging the four selected series into a combined volume index is shown, together with prices, in Chart 5. Throughout the period 1903-14, this volume index moves in close sympathy with all the major price changes, but tends frequently to lag about one quarter-year after prices. The co-

CHART 4. — LESS SATISFACTORY SERIES INDICATING VOLUME OF BUSINESS IN GREAT BRITAIN (CYCLES)

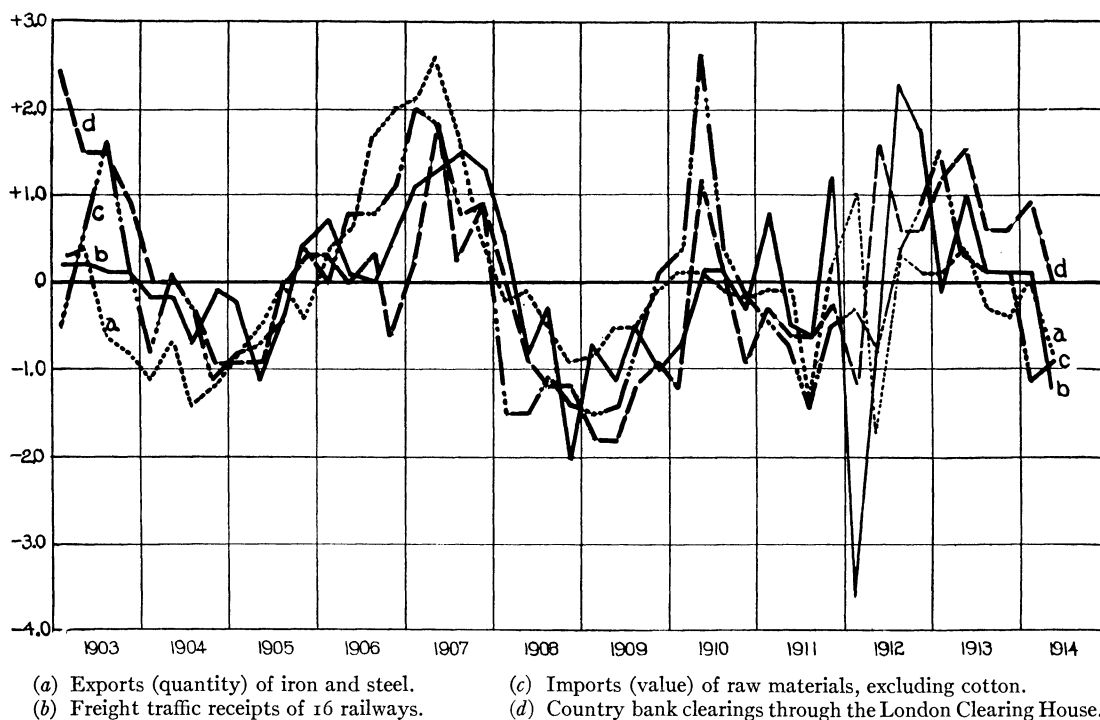
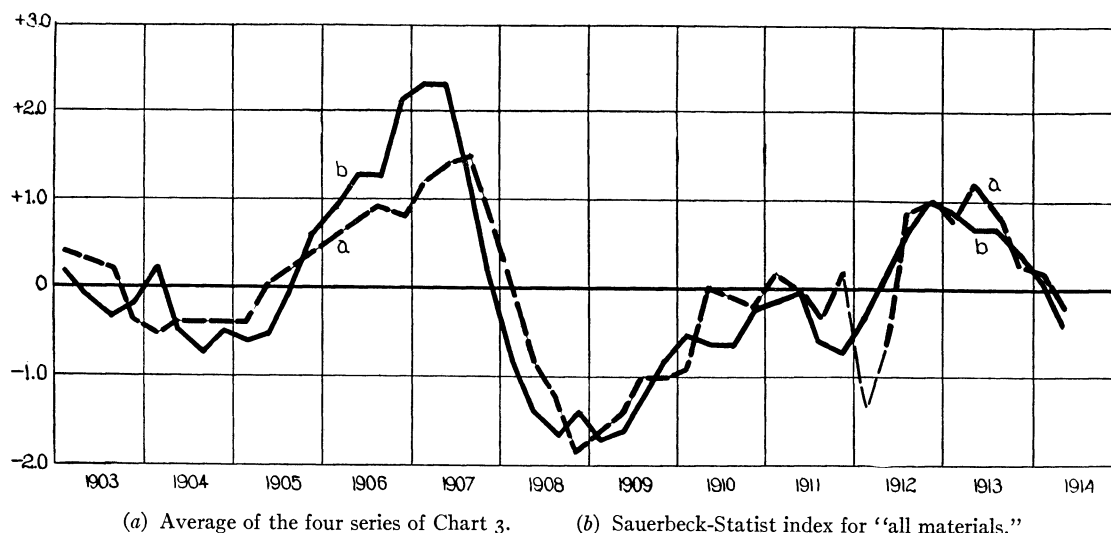


CHART 5. — INDICES OF THE VOLUME OF BUSINESS AND COMMODITY PRICES IN GREAT BRITAIN (CYCLES)



efficients of correlation are $+0.79$ for items of the volume index paired with those of the price index one quarter later, $+0.89$ between concurrent items, and $+0.91$ with the volume index lagging after prices one quarter.¹ The lag of the volume index is due largely to the two series which rep-

resent trade, viz. exports and provincial clearings. The agreement is more nearly concurrent between prices and the other two (non-price) components of the index — employment and

¹ In computing these coefficients the first two quarters of 1912 (when a national coal strike occurred) were excluded.

furnaces in blast. The lag of exports and clearings is a result which might have been expected because the production of goods must precede shipment of and payment for them; in other words, enlarged production is reflected in the trade figures of a quarter later. In constructing a general index of the volume of business, as has been said, series reflecting production and turnover have been combined.

Chart 5 presents a comparison of the curves representing commodity prices and the volume of business. In general, the curve for prices is smoother than that for volume. Certain events, such as labor disputes, occasionally affect the volume of business severely, while their effect on general prices is not evident. The price curve is not, however, without some erratic minor fluctuations of its own, which in numerous instances, are in a direction contrary to those of the volume curve. Nevertheless, the difference between the minor fluctuations is less striking than the similarity of the cyclical fluctuations of the two curves. Prices, on the one hand, and industry and trade, on the other, move substantially together during periods of prosperity and depression.

Let us consider for a moment the picture of British business as a whole in the twelve years preceding the Great War as revealed by Chart 5. The period began in 1903 with a mild reaction, followed by an interval of moderate depression. This was succeeded in 1905 by an upward swing which, halting momentarily in 1906, culminated in the second and third quarters of 1907. The reaction after the crisis of 1907 lasted about a year, coming to a halt at the end of 1908. Recovery in 1909 was uninterrupted, but reached only moderate proportions. In 1910-11, no steady progress was made and the years 1911 and 1912 were characterized by labor troubles in coal mining, transport, etc. which seriously affected most of the important manufacturing industries. The major cyclical movement, interrupted in its sweep by these incidents, culminated in the winter of 1912-13, but at a materially lower level than the peak of 1907. Then followed a recession, pronounced but much less precipitate than that of 1907-08. The intervals from trough to peak in 1904-07 and 1909-12 cover 3 or 4 years, but the ensuing periods of recession after the peaks of

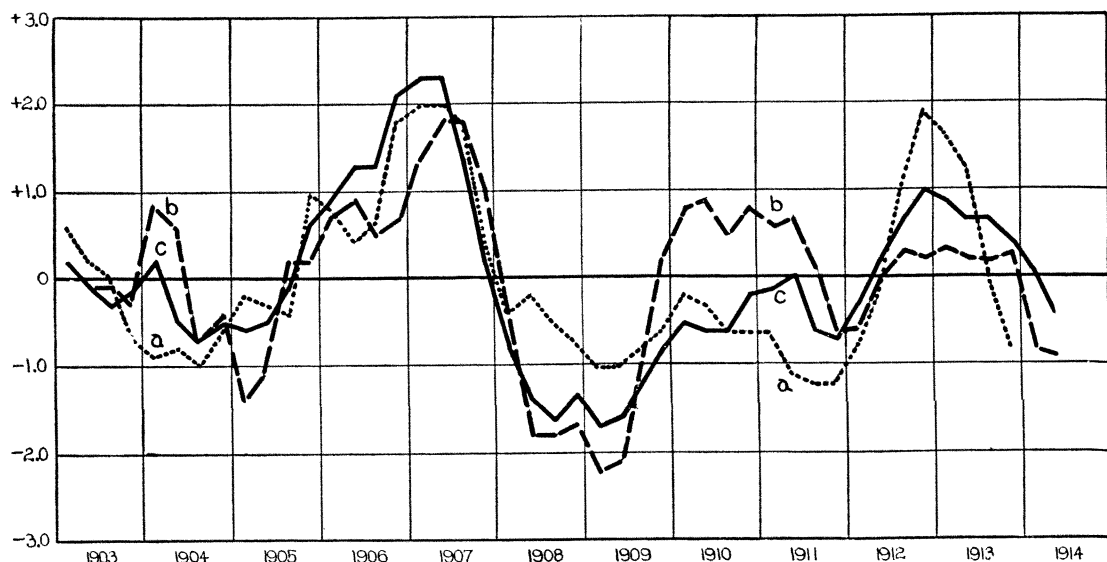
prosperity were very much shorter than the upward movements preceding the peaks.

The curves of Chart 5 which we have just been considering are based on series supposed to reflect "business in general" rather than the condition of a particular industrial group. The question arises: Does the fluctuation in activity of selected industries correspond to the fluctuation of business in general? In considering this question let us compare indices constructed for Great Britain's two leading manufacturing industries — iron and cotton textiles — with our index of business in general. Since data as to the volume of production of iron and of cotton textiles are lacking, we are forced to limit our comparison to prices.

As a barometer of the iron and steel trades we have taken the price of pig iron as shown by the average of Bessemer N. W. and Cleveland No. 3.¹ For the cotton industry a price index number was prepared from the price data for four standard cloths and two yarns.¹ The cycles of these price series are shown in Chart 6, together with the Sauerbeck-Statist series for "all materials," which includes the prices of cotton and iron together with those for many other articles. In the first half of the period the curves moved substantially in unison, the price of cotton goods appearing to lag somewhat after that of pig iron. In 1909-10 the indices of textile prices rose much more violently and to a higher level than did the others, whereas in 1912 the price of pig iron reached a peak not duplicated by cotton goods prices. As between these series for two leading industries it appears that iron prices are a better barometer of the general British price movement than are cotton prices. The basic materials upon which the two industries rest are affected by widely different circumstances. In the case of cotton textiles the price partly reflects that of American raw cotton, as is clearly shown in Chart 7; while in the case of iron, which is in large part a British product, the price probably reflects primarily conditions of the iron and steel industry at home. Furthermore, since the iron and steel industry is itself the foundation of a vast number of other industries, the price of pig iron would be expected to reflect much more accurately than would the price of cotton textiles the conditions of British industry in general.

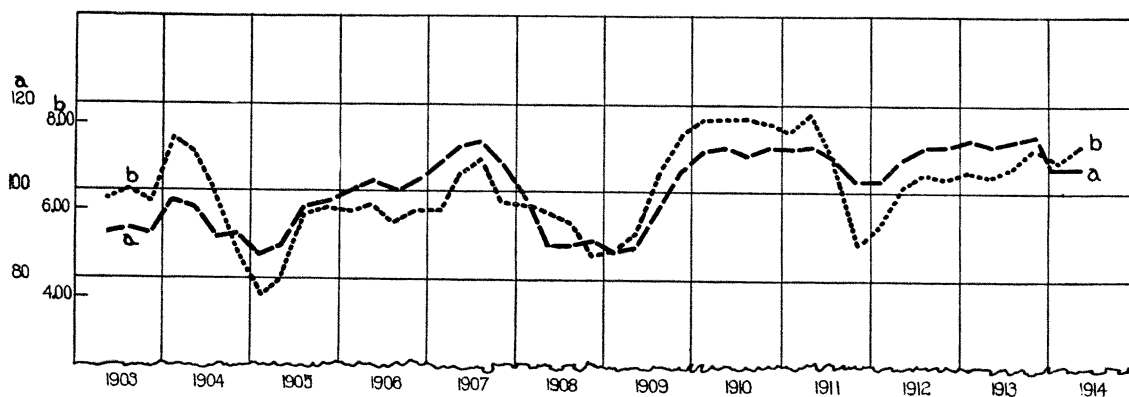
¹ As explained in Appendix, p. 176.

CHART 6. — BRITISH PRICE INDICES FOR PIG IRON, COTTON GOODS, AND "ALL MATERIALS" (CYCLES)



(a) Pig iron, average of Bessemer N. W. and Cleveland No. 3. (c) Sauerbeck-Statist price index for "all materials."
 (b) Cotton goods, average of 4 standard cloths and 2 yarns.

CHART 7. — (a) INDEX OF BRITISH COTTON GOODS PRICES; (b) PRICE IN LIVERPOOL OF AMERICAN MIDDLING RAW COTTON



Units: (a) one per cent (b) one penny.

II. FORECASTERS OF BUSINESS IN GREAT BRITAIN

We have found five statistical series depending upon commodity prices and the volume of trade and production which, after having been adjusted for long-time trend and seasonal variation, reveal wave-like movements similar in shape and timing and therefore probably picture the general course of British business in the years 1903-14. A further question presented itself. Can

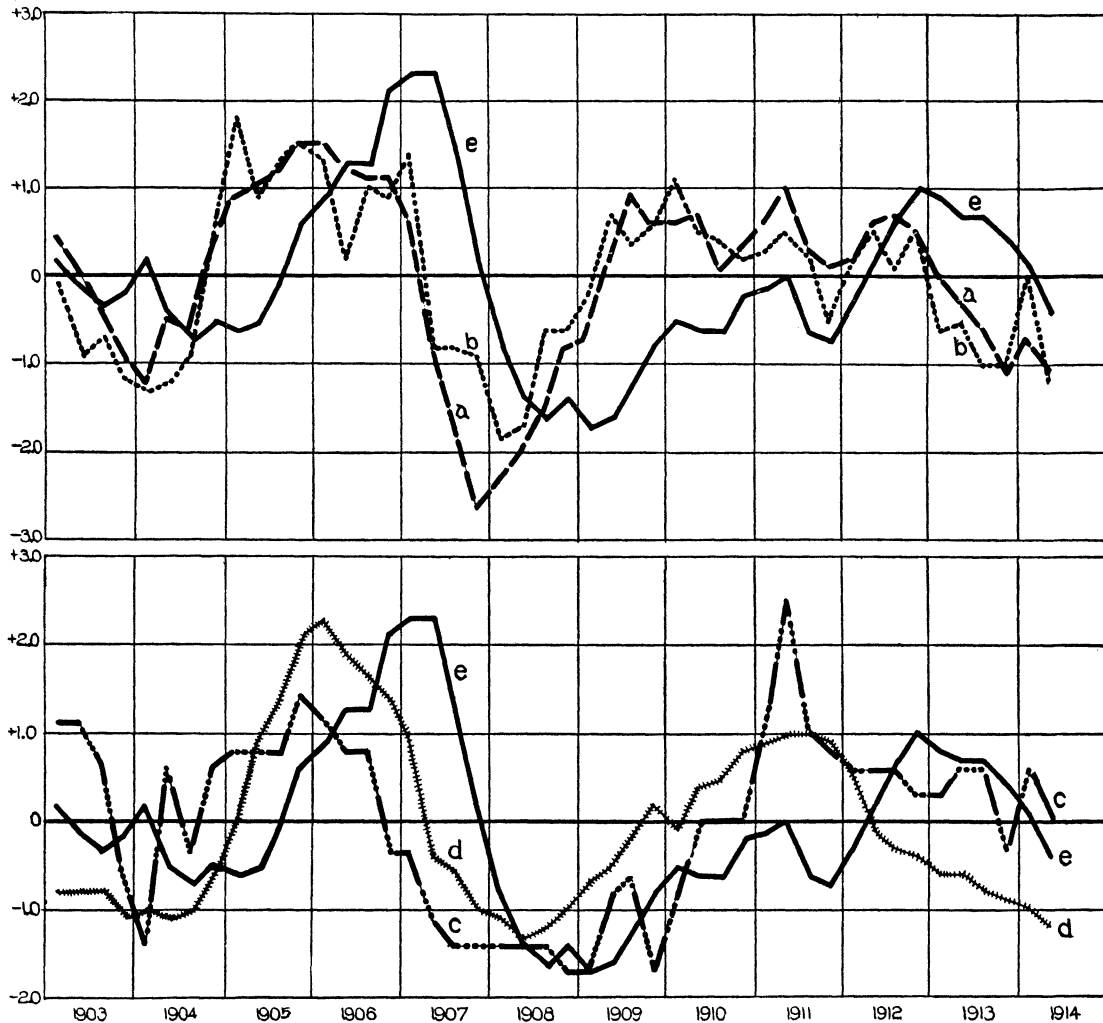
other series be found having cyclical fluctuations of similar form, but in advance of business. In other words, can we statistically forecast British business conditions in a manner similar to that already proved successful in the forecasting of American business?

In the endeavor to answer this question, attention was given to the statistics of organized security speculation in Great Britain. Purchases and sales of bonds and of many stocks are, of course, determined by conditions of the money

market as well as the present and anticipated yields of such securities. But speculation represents, essentially, the combined efforts of many

the London bank clearings on stock-settling days (two days in each month).¹ These figures depend, of course, upon both the number of shares

CHART 8. — BRITISH SERIES FORECASTING PRICE MOVEMENTS (CYCLES)



- (a) Market values of variable income securities (*Bankers' Magazine* total, less fixed-income securities).
 (b) London clearings on stock settling days.

- (c) Market values of selected British railway ordinary stocks.
 (d) Stores of Cleveland pig iron in public warehouses.
 (e) Sauerbeck-Statist price index for "all materials."

persons, equipped with varying degrees of acumen and business judgment, to anticipate the probable future course of business profits and therefore of business conditions.

Security speculation, like business, may be measured by statistical series representing either volume or prices. The number of shares sold on the London Stock Exchange is not published. Nevertheless, a gauge of the fluctuations in the total value of security transactions may exist in

sold and their price. The adjusted figures for the series, presented with commodity prices in Chart 8 (curves *b* and *e*), indicate a general movement about one year in advance of prices; but the presence of many irregular minor movements

¹ Attention was also given to London clearings on "consols settling days," but these do not exhibit the forecasting tendency present in the total clearings. The London clearings for "fourths of the month" and for "ordinary days" showed no significant result. See the Appendix (p. 179) for further details.

seriously impairs the value of the series as a dependable forecaster for short periods.

A vast amount of statistical material relating to security prices in Great Britain are available in the *Investors' Monthly Manual* and other periodicals, but carefully constructed indices do not exist. The only indices available are the "aggregate market values" of selected groups of securities published by the *Bankers' Magazine*. The aggregate relates to more than 300 securities, for which sub-totals are given by groups — "British and Indian Funds," "American Railways," etc. For the individual securities entering the list the current market price of each issue is multiplied by the total number of shares of that issue outstanding. Although the securities included differ widely from one other,¹ the aggregate was found to forecast moderately well the major movements of business. Constituents of the aggregate, the values of securities bearing fixed incomes and those bearing variable incomes, however, move in different ways. Consequently, the fixed-income groups were eliminated from the aggregate. The fluctuations of the total of the variable-income groups is shown in Chart 8 (curve *a*). The values of the variable-income securities are, on the whole, a more accurate forecaster of commodity prices (curve *e*) than are London clearings on stock-settling days (curve *b*).

The two forecasters just considered have a common characteristic in that they probably forecast not only the prospects of British conditions but, to some extent, those of the world as a whole. The London Stock Exchange, more than any other exchange, is an international market. The world-wide range of British commercial interests and the centering of much of the world's financial mechanism in London render its speculative operations highly sensitive to foreign influences. Furthermore, our group of "variable-income securities" includes a large number of foreign and colonial securities.

In order to find a group of securities of which the values would perhaps be less affected by foreign circumstances than the group we have used, the various groups of securities compiled by the *Bankers' Magazine* were charted and studied;

but only one series — that for the prices of twenty-six British railway ordinary stocks — proved to be a reasonably satisfactory forecaster of commodity prices (curve *c*).

A series of an entirely different character from the three thus far considered (except that it is similar to the prices of British railway stocks in that it relates mainly to British conditions) is also presented in Chart 8 (curve *d*). This is based upon the amount of pig iron reported as stored in public warehouses.² These warehouses, formerly operated by the firm of Connal & Co., were located in the large iron centers, chiefly in Scotland and the Cleveland district. Pig iron was stored, under certain regulations as to quantity and grade, and "warrants" were issued to the ironmasters against it in much the same manner as warehouse receipts are given for American wheat in terminal elevators. The *Iron and Coal Trades Review*, the *Economist*, and other periodicals formerly printed the amounts of these stocks held each month in the Scotland and Cleveland warehouses. The series for Cleveland, which was after 1903 by far the more important, was found to vary with some regularity in advance of general business.

In general, the cyclical fluctuations of the four series just considered (curves *a*, *b*, *c*, and *d*) precede the cyclical fluctuations of prices and business by periods ranging from nine to fifteen months. In selecting the best forecasting index, however, it has not been thought desirable to average the four. The heterogeneous character, from an economic point of view, of the group is one reason against such a combination. Furthermore, two of the series can no longer be used: London stock-settling clearings no longer have their former significance,³ and figures for the stocks of pig iron on hand are no longer available. A third series, the prices of British railway securities cannot now be depended upon to forecast business activity, owing to government operation of railways. Consequently, the series representing the values of the variable-income securities (curve *a*) is the only one which promises to be of current usefulness. This series registers the common tendency of the other three forecasters for the period 1903-14. Its fluctuations precede those of prices by three-quarters of a year ($r = +.80$) and those of the volume of business by a full year ($r = +.86$).

¹ See Table 6 of the Appendix.

² Since 1914 the figures have not been published and the practice of storing pig iron has been discontinued.

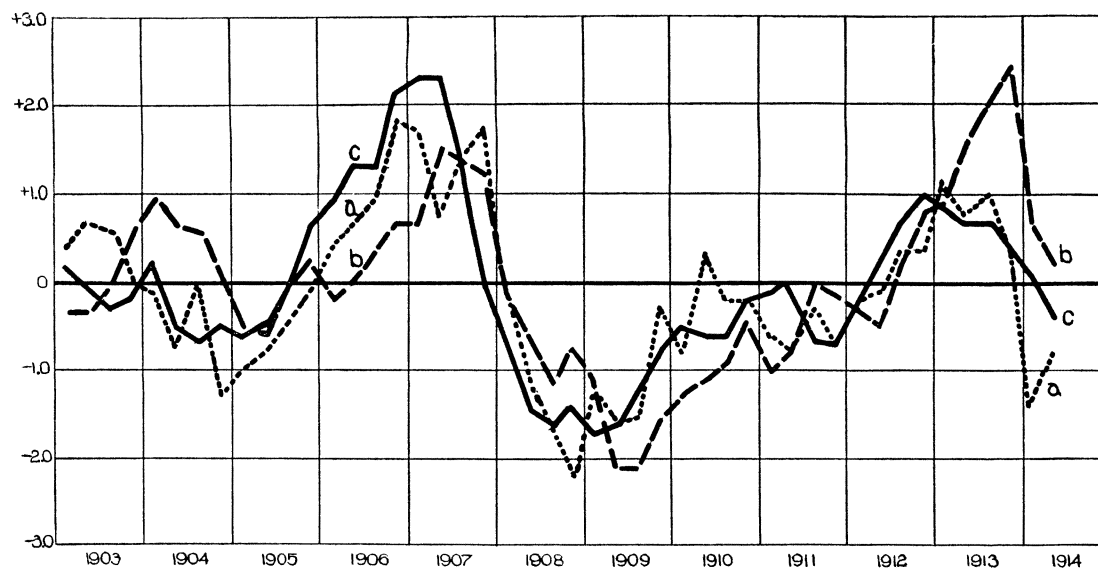
³ The clearing house no longer compiles them.

III. BANKING AND INTEREST RATES IN GREAT BRITAIN

In the study of business cycles in the United States, it was found that the cyclical movements of certain series — namely, short-time discount rates and loans of New York banks — lagged about four months after the series representing commodity prices.¹ Does a similar relationship exist for British series?

The series of quarterly average discount rates for three-months bills, duly adjusted for a marked seasonal variation and a slight upward trend, is presented graphically in Chart 9 (curve *a*). Comparing this series with the standard price series (curve *c*), we find that the highest correlation between the two series is for a lag of one quarter in discount rates ($r = +.84$) but that the correlation between concurrent items is nearly as high ($r = +.81$). Minor movements in discount

CHART 9. — BRITISH DISCOUNT AND INTEREST RATES COMPARED WITH PRICES (CYCLES)



(a) Discount rate on three-months paper in London.

(b) Market values of 7 local government bonds (signs reversed).

(c) Sauerbeck-Statist price index for "all materials."

In investigating this question, monthly series of the average rates of discount on two-, three-, and six-months bills were collected, charted, and compared. It was found that the fluctuations of these series showed an exceedingly close agreement with each other and, therefore, any one of the series could be taken as thoroughly representative of the discount market (and even fairly representative of the market for "floating" money). The series for the rate of discount on three-months paper, in the form of quarterly averages for comparison with quarterly prices, was selected as representative of the short-time money market in Great Britain.

rates appear — for instance, a double "peak" in 1906-07 which is not reflected by either prices of materials or the volume of business, and also vibrations in 1904, 1909, and 1910.

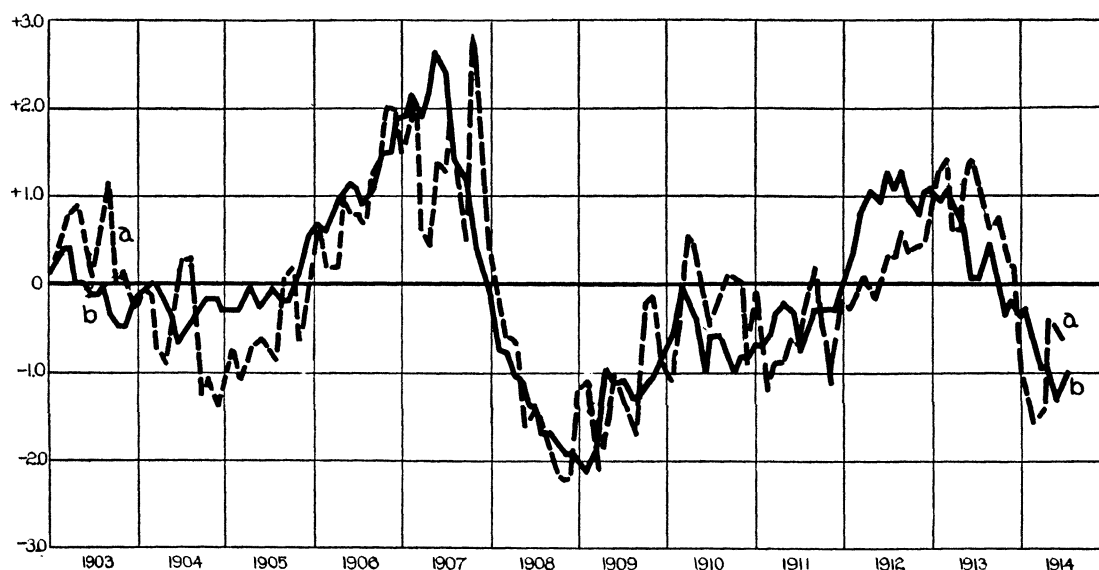
In order that the time relationship between the two series representing, respectively, discount rates and commodity prices may be set forth as clearly as possible, the *monthly* cycles² have been computed and plotted (Chart 10). Examination of this chart reveals, first, that discount rates tend to oscillate from month to month, second, that all commodity prices reach maxima (in 1907 and 1912) some months before discount rates, but third, that on the whole the cyclical fluctuations of discount rates do not show a clearly defined tendency to lag behind those of prices of all commodities.

The rate of discount is, of course, but one of

¹ See Table F, p. 182 of the REVIEW for April, 1919.

² Since the indices for the group of "all materials" are not available in monthly form the indices for "all commodities" were used.

CHART 10. — BRITISH MONTHLY DISCOUNT RATE COMPARED WITH MONTHLY PRICES OF "ALL COMMODITIES"



(a) Discount rate on three-months paper in London.

(b) Sauerbeck-Statist price index for "all materials."

several series which may be used as an index of bank credit. Expansion and contraction of credit can be measured directly if we can secure satisfactory data for bank loans, deposits, and reserves. It happens that no British figures of a homogeneous and dependable character exist in accessible form. Most of the large London joint-stock banks, it is true, issue statements of their accounts; but the data are published irregularly and the rapid progress of bank amalgamations makes it practically impossible to secure homogeneous series of any length. Only the accounts of the Bank of England are published in a form suitable for the present purpose. Analysis, however, of the non-governmental deposits and loans, and of the reserve of the Bank proved disappointing. These cycles did not exhibit any appreciable similarity to those representing business, and no further examination of the various other items of the Bank's accounts was undertaken. The only significant "banking" series available for this period, therefore, appears to be the market rate of discount.

It is desirable to ascertain the nature of the relationship between the cyclical fluctuations of discount rates and interest rates on long-time investments. Approximation to the long-time rate has been obtained from the following data,

based on high-class investment: (1) the market values of 7 British local government ("corporation") bonds; (2) the market values of 129 leading fixed-income securities; (3) the price of consols. Only in the case of the third series was it possible actually to convert prices into rates of yield, but a substantially equivalent result was accomplished for the other groups by computing cycles of the values, and inverting their cycles by reversing the algebraic signs of the items.

Comparison of the cycles of groups (1) and (2) disclosed a very close agreement, which lends strong support to the belief that in respect to yield, long-time investments, as a class, both British and foreign, do not differ materially from the small sample represented by British local government bonds. It was also observed that the yield on consols agrees with these two groups, notwithstanding the influence of national and international political factors. The agreement was, however, not as close as that between groups (1) and (2). Group (1) was, therefore, chosen as probably the best single register of the long-time interest rate. Cycles for this series, which are presented in Chart 9 (curve *b*) appear to have a time relationship to commodity prices different from that of discount rates; the former fluctuates with surprising regularity about six

months after the prices (coefficients of correlation between prices and the yield of 7 local government bonds for a lag of the latter of 3, 6, and 9 months are $+0.77$, $+0.79$ and $+0.70$, respectively), whereas discount rates do not lag more than one quarter after prices. Thus, the position which the rate on commercial paper in New York occupies in the index of business conditions for the United States, the long-time rate of interest appears to occupy in the British index.

In the frontispiece (p. 158) the series selected to form the Index of British Economic Conditions for the period 1903-14 are brought together. Prices (B), reflecting the general ebb and flow of business, tend to be forecast by speculation (A) and to be followed by the long-time rate of interest (C).

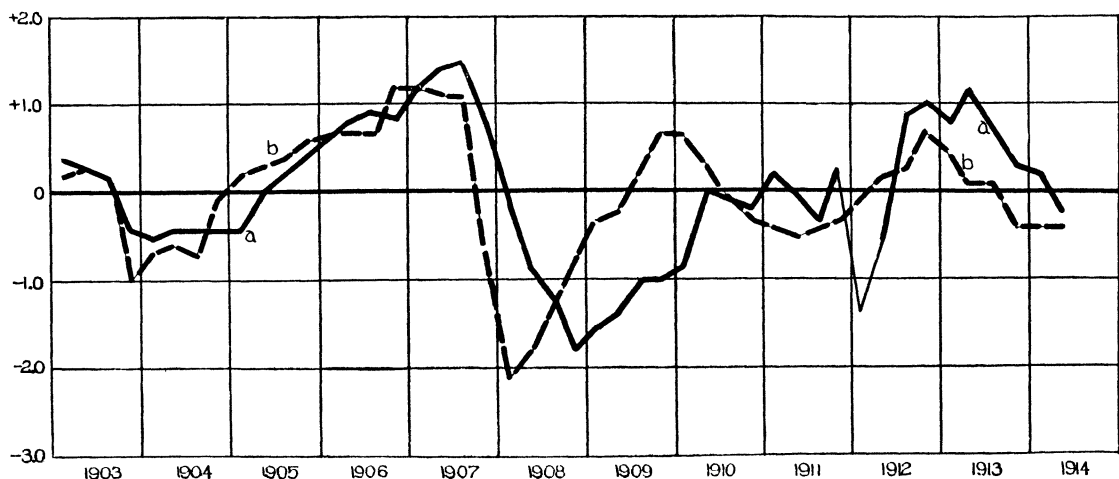
IV. COMPARISON OF THE INDICES FOR GREAT BRITAIN AND THE UNITED STATES, 1903-14

The criterion used in judging the various series of British business statistics has been the relationship among their fluctuations, particularly the relationship of each series to wholesale prices. Although the statistical technique and the working hypothesis were derived from the study of business statistics in the United States, to which

we have frequently referred in the preceding pages, the likeness or unlikeness of a British series to an American series played no part in evaluating the significance of any British series. In other words, the problem of the relationship of British speculative, business, and banking movements to each other, as shown by various statistics, was considered by itself; no assumption was made as to relationships that might exist between series for Great Britain and the United States. In view, however, of the close commercial and financial relations between the two countries, it is probable that some correspondence exists between the two sets of statistical series. A comparison between the series utilized for the two countries is therefore presented.

A comparison was first made between the volume of British and of American business (Chart 11). In both the United States and Great Britain the first depression of the period 1903-14 began late in 1903; American business revived in 1904 while British business was depressed until the beginning of 1905. Recovery, once begun, proceeded in both countries, and business was active until late in 1907, when the crisis of that year was followed by rapid, even precipitate liquidation, particularly in the United States. Liquidation lasted in Great Britain some nine months longer than in the United States. Sub-

CHART 11. — COMPARISON OF BUSINESS VOLUME INDICES FOR GREAT BRITAIN AND THE UNITED STATES
(CYCLES)



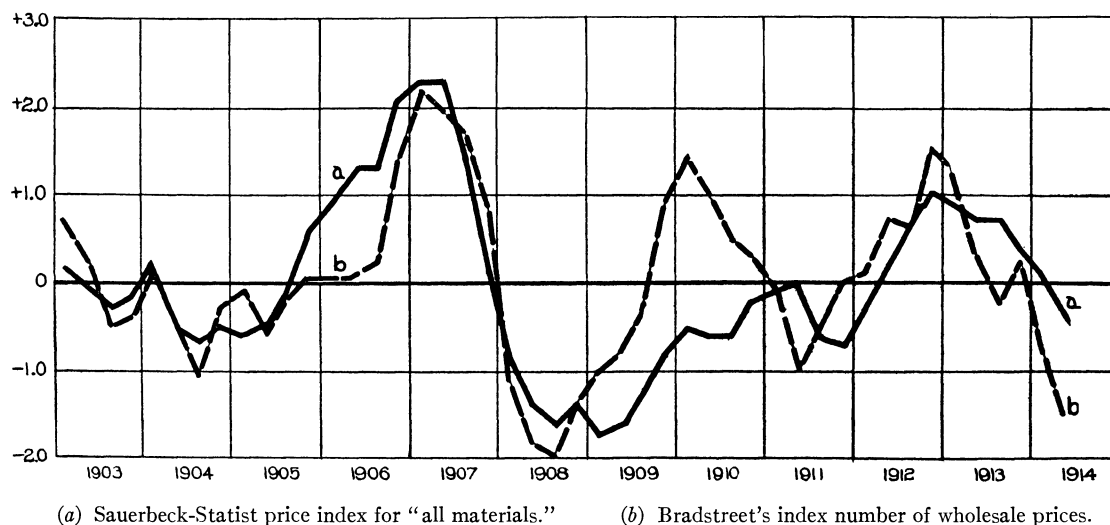
(a) Index of the volume of business for Great Britain.

(b) Index of the volume of business for the United States: average of pig iron produced; bank clearings outside of New York City; imports of merchandise; unfilled orders of the U. S. Steel Corporation; and Bradstreet's number of business failures.

stantial recovery occurred in the United States in 1908, and continued through 1909, when it gave way to a decided recession until the middle of 1911. Neither the rapid recovery nor the subsequent depression in the United States was more than faintly paralleled by British business. By the middle of 1911, the American depression,

The curves for wholesale prices¹ in the two countries, shown in Chart 12, are more similar to each other than are the curves for the volume of business. The curious tendency for the British series to lag after the American is again seen at several points, particularly in 1907, 1909 and 1911. At other points, however, there is sub-

CHART 12. — COMPARISON OF WHOLESALE PRICES IN GREAT BRITAIN AND THE UNITED STATES (CYCLES)



which attained only moderate severity, gave place to recovery; meanwhile, in Great Britain, during the first half of 1912, the national coal dispute was seriously hampering business. The latter part of 1912 and the early months of 1913 witnessed substantial prosperity in both countries, followed by a recession which continued until the outbreak of the War.

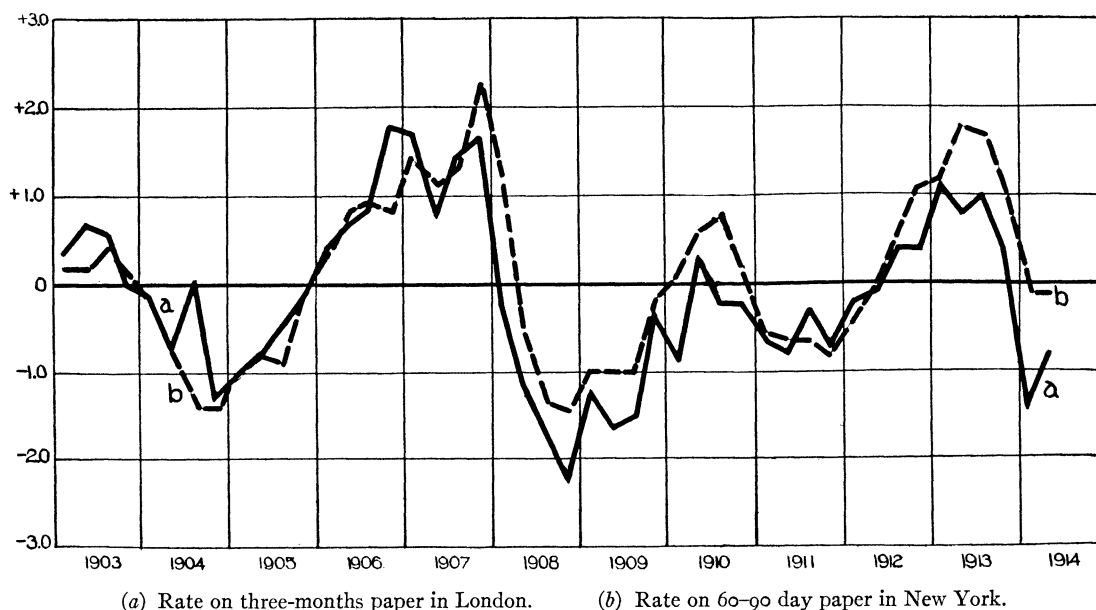
Notwithstanding the general similarity between these indices for the United States and Great Britain, three important differences are noticeable. In the first place, business activity in the United States reached its peak in 1909-10 and immediately afterward suffered a recession, while British business was making a gradual recovery from the depression of 1908, which recovery was followed by a sidewise movement in 1910-11. Secondly, and more important, the British index tends frequently to lag after that for the United States. This phenomenon appeared in 1904-05, in 1908, in 1910, and in 1913. Finally, there was a more rapid rate of decline of business in the United States after the depression of 1908 than there was in Great Britain.

stantial concurrence. Here again the conspicuously high peak of the American curve in 1909-11 appears. It has already been pointed out that in Great Britain fluctuations in the volume of business appear to lag about one-quarter year after those in prices. By comparing Charts 11 and 12, it is observable that in the United States fluctuations in the volume of business often precede those in prices, i. e. the order is reversed. This relationship is not invariable; it tends to be most consistent in periods of recovery, such as 1904-05 and 1908, whereas the breaks from business prosperity to depression are almost simultaneous.

A further comparison may profitably be made between the rates of discount on commercial paper in London and New York; the cycles for these series appear in Chart 13. There is a very much closer agreement between the curves, both

¹ American prices are represented by Bradstreet's index of wholesale prices of 96 commodities. This was taken as the best register of cyclical price movements in the United States available at the time the study was in progress, early 1921. Since then a price index of business cycles has been constructed (see REVIEW for November, 1921).

CHART 13. — COMPARISON OF DISCOUNT RATES IN LONDON AND NEW YORK (CYCLES)



in point of time and in amplitude, than in the pairs of series previously compared. The general agreement is indeed so close that only minor differences attract attention. It is obvious that the curve for British discount rates is more irregular than the American, especially in the years 1909-14. The greater irregularity of British rates may mean that the London money

market is a shock absorber for the financial world.

An equally striking agreement appears in the case of the price of variable-income securities for the two countries, shown in Chart 14. Curve *a*, selected as the best available forecaster of British business, agrees closely in its cyclical movements with curve *b* for the United States based

CHART 14. — COMPARISON OF PRICES OF VARIABLE INCOME SECURITIES IN LONDON AND IN NEW YORK (CYCLES)

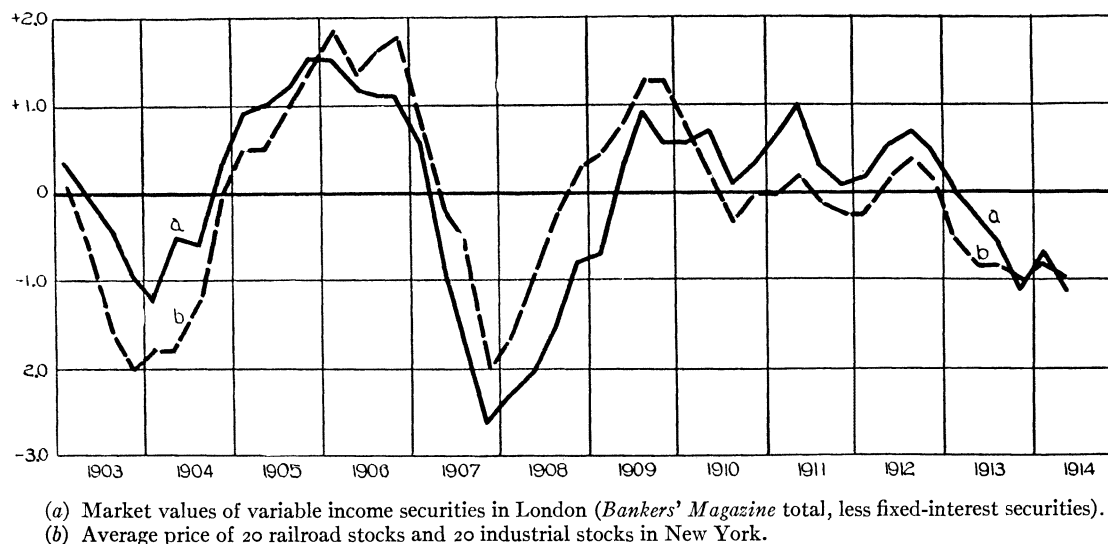
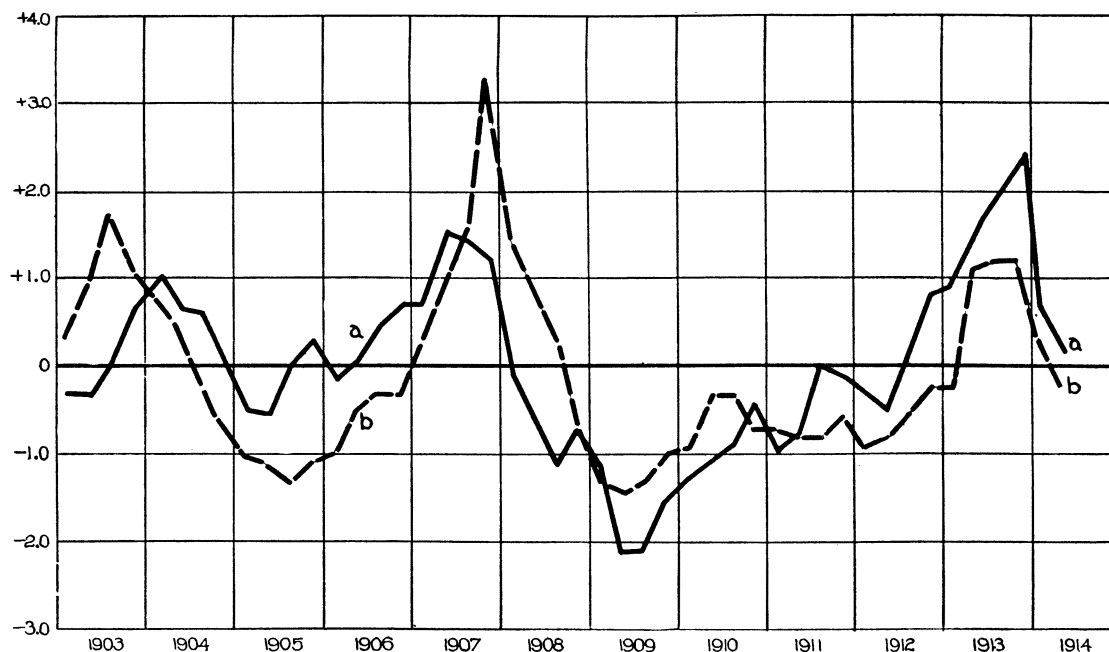


CHART 15.— COMPARISON INTEREST RATES ON BONDS IN GREAT BRITAIN AND THE UNITED STATES (CYCLES)



(a) Market values of British local government bonds (signs reversed). (b) Average yield on 10 American railway bonds.

upon essentially similar data, and forming an important constituent of the American forecaster.

Turning now to interest rates on long-time investments, as represented by bonds of British local governments and American railroads, we find an agreement which is moderately similar in form but markedly irregular in sequence. The course of the two curves (Chart 15) shows that sometimes the British rate lags, sometimes it precedes. This feature does not appear to be due to accidental differences in the selection of representative bonds, for it was found that the yield on British railway debentures, the nearest counterpart to the American railroad bonds, showed substantially similar results. Another comparison was made, between the yield on ten American railroad bonds and the market value (reversed) of British consols, with less satisfactory results.

The coefficients of correlation between the corresponding pairs of British and American series present in summary fashion the results which have just been outlined.

Summarizing the comparison of the leading pairs of series for Great Britain and the United States, it may be said that a progressively closer

British and American indices of	Coefficients of correlation for concurrent adjusted indices
The volume of business	+ .53
Commodity prices	+ .67
Stock prices	+ .81
Discount rates	+ .84

international agreement is found as we pass from the series representing the volume of business, to commodity prices, to the prices of speculative securities and to short-time discount rates.

V. SUMMARY

For the United Kingdom during the period 1903-14:

(1) The cyclical fluctuations of trade — foreign and domestic — and industrial activity are indicated by four series which were found to move in such close unison as to warrant averaging them in order to iron out the fluctuations peculiar to each series. These four series are (a) exports of British produce, (b) bank clearings in five provincial towns, (c) percentage of unemployment in all trades (signs reversed), and (d) blast furnaces in blast. The average of these series gives an index which moves in close sympathy with all the major price changes, but tends

frequently to lag about one-quarter year after prices.

(2) The price of pig iron is a fairly good index of business conditions in the United Kingdom, but the movement of the price of cotton textiles at times diverges considerably from that of business in general.

(3) The movements of prices of variable income securities forecast those of commodity prices and the volume of business by nine to twelve months. The available indices of British stock prices, however, are entirely unsatisfactory and for forecasting purposes homogeneous indices should be constructed from the prices of representative domestic industrial stocks.

(4) The movements of rates for short-time

money show some tendency (although not invariable) to lag a quarter of a year behind commodity prices, while the average yield on seven British local government bonds fluctuates with surprising regularity about six months after prices.

(5) Some significant differences are noticeable between the indices for the United States and Great Britain, perhaps the most important being the tendency of the British index of the volume of business to lag after that for the United States. A progressively closer international agreement is found as we pass from the series representing the volume of business, to commodity prices, to the prices of speculative securities, and to short-time discount rates.